Title - Integrating Geographic Information Systems (GIS) into RIT's Curriculum

Applicants:
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College Science
Dr. Jason Younker 475-5549 Dept. Sociology and Anthropology College
Liberal Arts

Project Summary

The project sought to develop teaching resources, train or work with interested faculty, and compile geospatial databases to help enhance the use of geographic information systems (GIS) in existing RIT courses and to help develop new courses and research projects. Dr. Younker and Dr. Korfmacher, assisted by two student research assistants in 2005, worked directly and indirectly with 13 faculty over the past three years to develop three courses, three course modules, and participate in six research projects. The student researchers compiled several GIS databases and case study materials that have been used in a number of GIS courses. The project also sought to help develop a multidisciplinary GIS Minor, which is still under development but close to submission.

Targeted Learners and Number of Students Impacted

In our proposal, we sought to include faculty and courses from as many colleges as possible. GIS is an interdisciplinary tool, and there are examples and case studies for virtually every discipline. For an overview, see the book Understanding Place - GIS and Mapping Across the Curriculum, Diana Stuart Sinton and Jennifer Lund, 2007, ESRI Press (Dr. Korfmacher is the lead author of chapter 14). We had identified a number of faculty who had previously approached us about assistance with GIS in classes and projects, and these covered COS, COLA, NTID, and CAST. In an attempt to reach beyond these colleges, Dr. Korfmacher gave a presentation at the 2005 FITL conference entitled Mischief Managed – An Introduction to Geographic Information Systems, which provided an overview of various GIS data, example GIS applications, and sources of free data and software, in addition to outlining the PLIG project and extending an invitation to participate in this project. Several FITL participants later became involved in the PLIG project, although it is unclear...
whether they were influenced as a result of the FITL presentation (clipboard survey questions did not address this issue).

Below is a list of faculty who have been involved on the project at some level, along with the number of students we estimate have been influenced by the project, since 2005, based on course enrollments. While we initially envisioned the project lasting only a year, we found that we needed up to three years to roll out all the courses and class modules initiated under the grant due to scheduling conflicts and resource limitations (see Recommendations Section).

<table>
<thead>
<tr>
<th>NAME</th>
<th>COLLEGE</th>
<th>PROJECT</th>
<th># OF STUDENTS</th>
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<tbody>
<tr>
<td>Karl Korfmacher</td>
<td>COS</td>
<td>COURSES, RESEARCH</td>
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<tr>
<td>Jason Younker</td>
<td>COLA</td>
<td>COURSE</td>
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<td>Christy Tyler</td>
<td>COS</td>
<td>MODULE</td>
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<td>James Myers</td>
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<td>Elizabeth Hane</td>
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<td>Robert Rothman</td>
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<td>Mary Lynn Broe</td>
<td>COS</td>
<td>RESEARCH, COURSE</td>
<td>6 ***</td>
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<td>Bob Cole</td>
<td>CIAS</td>
<td>RESEARCH, COURSE</td>
<td>0 ***</td>
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<td>Nina Raqueno</td>
<td>COS</td>
<td>RESEARCH, COURSE</td>
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<td>Stasa Puskaric</td>
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<td>James Winebrake</td>
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<td>RESEARCH</td>
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<td>Scott Hawker</td>
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<td>Theresa Wolcott</td>
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<td>Justin Grigg</td>
<td>CAST</td>
<td>GIS DATABASE</td>
<td>30 **</td>
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<tr>
<td>Ann Howard</td>
<td>COLA</td>
<td>RESEARCH</td>
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</table>

** Three Year Student Total ** 347

* Over the three years since the award
** Two year period
*** Honors course taught by Broe, Cole, Raqueno, and Korfmacher – six students total

**Impacts on Teaching and Learning**

**GIS Applications in Urban and Community Studies.** Dr. Younker developed this course for the Urban Community Studies program students wishing to major and minor in this area. In addition, this course was identified as being a key course for the multidisciplinary GIS minor. Kelvin Peek, a student researcher on the project in 2005, worked with Dr. Younker in designing this course. They tested exercises provided in *Exploring the Urban Community: A GIS Approach* (Green & Pick, 2006) to ensure that the text was at the appropriate anticipated level for
UCS students. This text was adopted. They compiled data sets for Monroe County, New York so that supplemental exercises could be created and prepared a course syllabus.

**Environmental Science - GIS.** Dr. Korfmacher taught two sections of this new course (50 students total) for ACMT while on sabbatical there in 2006. The course focuses on environmental issues around Dubrovnik, Croatia, in addition to introducing students to basic GIS skills. He worked closely with Dr. Stasa Puskaric while at ACMT. ACMT is interested in developing a hybrid environmental science/management program, and GIS figures prominently in these plans. While the course materials and databases are ready, barriers to offering this course regularly involve finding a local GIS instructor in Dubrovnik, since distance learning does not seem to be a viable solution at this point, and software licenses, since the RIT University Site License for the ArcGIS software does not extend overseas.

**Environmental Science Field Studies** – Dr. Korfmacher has been working with Dr. Tyler on several exercises that use GIS in water quality analyses and soils mapping and analyses. These modules utilize databases Bryan Correa-Berger compiled as a student research assistant in 2005. Students use GIS maps to help identify sources of non-point source pollution in the Allen Creek watershed, which they correlate with water quality samples. In the soils exercise, the students take a soil sample, analyze soil texture, color, and form, and then relate their results to digital soil maps. Locations of the soil cores are mapped using GPS receivers. Students are also introduced to the Web Soil Survey (http://websoilsurvey.nrcs.usda.gov/app/), which allows them to map soil parameters within their area of interest. It is an example of an Internet Map Server (IMS) that students with minimal training can effectively use in environmental projects.

These exercises and databases were also tested and used in an NSF workshop that Dr. Korfmacher lead in the summer of 2005, training faculty from around the eastern US on the use of GIS in watershed analyses. These exercises now form the basis of an expanded faculty training workshop program submitted to NSF as a CCLI Phase III proposal by Dr. Korfmacher (with faculty from SUNY Brockport, Alfred University, and the University of Wisconsin).

**Conservation Biology** – Bryan Correa-Berger identified and tested three exercises from a GIS case study collection produced by the United Nations Institute for Training and Research (UNITAR) that fit well with topics covered in Conservation Biology, taught by Dr. Elizabeth Hane. These are self guided exercises, but Dr. Korfmacher and Dr. Hane co-teach a three-week lab exercise that integrates course materials, major concepts, and local examples into the
existing modules, helping to strengthen concepts and applications. The course uses a GIS program called IDRISI. GIS is an increasingly important tool in ecology and conservation biology, and Bryan used GIS in his MS thesis, *Developing a habitat suitability model for the spotted turtle using a hybrid-deductive approach*. Dr. Hane and Dr. Korfmacher hope to eventually modify this MS thesis into a course lab project.

**Galapagos: Ecology and Evolution** - Dr. Bob Rothman approached us about developing 3-D maps of the Galapagos Islands and the surrounding ocean area to help provide his students with a visual aide to understanding the unique environmental parameters that have helped shape the ecology and evolution of this area. Bryan Correa-Berger developed a preliminary database, but the resolution of the available data was poor. This year, high resolution data has become available and several GIS models have been developed for the class. Additionally, Dr. Rothman has been working with Google Earth to supplement the models we have provided, and Dr. Korfmacher is working on ways to integrate this information into Google Earth.

**Cultural Uses of the New Cartographies: Interdisciplinary Negotiations** - This COLA/CIAS/COS honors course, to be taught the first time in 2007.3, was developed out of a conference project that Dr. Broe initiated in the summer of 2006. Dr. Raqueno, Dr. Cole, and Dr. Korfmacher were asked to join Dr. Broe on a panel at the biannual meeting of the Society for Science, Literature and the Arts, June 13-16, 2006 in Amsterdam, the Neatherlands. That project integrated digital mapping, remote sensing imagery, abstract landscapes, and literature into a discussion of how we view and understand maps and mapping and our sense of place. The team will recreate the project in a course, with students experimenting with various forms and concepts of mapping, including a four week investigation into the ecological restoration of Red Creek (the stream that flows through campus). The Red Creek project is envisioned to be part of the Caroline Warner Gannett Speaker Series in 2008-9, when the Center for Land Use Interpretation presents. Dr. Broe and Dr. Raqueno are also participants on the GIS Minor workgroup.

**The Geographic Intermodal Freight Transportation (GIFT) Project** - Dr. Winebrake and Dr. Hawker began this project to model pollutant emissions from various modes of freight transport using GIS network analyses. Dr. Korfmacher is a collaborator on this project, and early versions of the model utilized several GIS databases created during the PLIG project.

**Civil Engineering Technology Surveying** - The CAST Environmental Management and Civil Engineering Technology programs are working to include more GIS in their curriculum. They recently purchased several high end global positioning system (GPS) receivers, which they plan to work with in Route Surveying taught
by Theresa Wolcott. Dr. Korfmacher will be providing GIS data as needed for this course and will help assist in the GPS data collection exercise using Mobile GIS software. This course will be taught using the GIS materials in 2007.3.

**Introduction to Geographic Information Systems** - This was the first course developed for James Myers' new Geographic Technology program. Although not developed as part of the PLIG project, Dr. Korfmacher worked with Justin Grigg, the instructor of Introduction to GIS, by working with him on the syllabus, providing GIS databases, and assisting in several of the lectures and exercises.

**Northeast Neighborhood Alliance (NENA) GIS Project** - Dr. Korfmacher has worked with Ann Howard on the NENA project for several years, and as part of this service learning project that she coordinates, compiled GIS databases and maps for use in courses, grants, and community research.

**Impacts on Student Success**

The desire to use GIS is growing. At ACMT, over half of the students wanted a second GIS course made available, based on course evaluations. In Dr. Korfmacher’s GIS courses, a growing number of students are coming from outside the environmental programs. While it is still too early to tell if all modules are effective, the modules that have been used in courses to date seem popular with the students, especially in Environmental Science Field Studies and Conservation Biology, where many of the students who were exposed to GIS went on to take additional GIS courses. Interest in the GIS minor remains high among students taking GIS courses, although certain barriers are slowing that initiative (see recommendations below). Several students have signed up for the Environmental Modeling minor, offered through the Environmental Science Program, which is the closest thing we currently have to a working GIS minor. Additionally, a number of students have received jobs or coops based on their GIS training.

**Dissemination**

Dr. Korfmacher presented the PLIG GIS initiative at the 2005 FITL conference at RIT. He plans to present at FITL again in 2009, once several additional courses and modules roll out or are taught a second time. He also presented the outline for the multidisciplinary GIS minor at the 2005 GIS/SIG conference held at the RIT Inn and Conference Center to gather feedback from local GIS professionals.

If funded by NSF, Dr. Korfmacher will be presenting the GIS faculty training workshop curriculum from his CCLI project at the 2009, 2010, and 2011 ESRI GIS Educators Users Conferences and will conduct scaled down versions at those conferences in collaboration with ESRI, the developers of the ArcGIS software.
suite. ESRI has expressed a keen desire to participate in and facilitate this kind of training.

**Recommendations and Next Steps**

While we made progress, several barriers arose that prevented us from rolling out our project as quickly as planned. Dr. Younker had planned to teach his new course, GIS Applications in Urban and Community Studies, in the 2005.2, but departmental scheduling conflicts delayed that course until 2006.2. This is an increasingly common problem. Several faculty we had identified and approached about teaching new GIS-related courses were unable to free up enough time and were unwilling to teach overloads, due to other institute commitments. This has had cascading impacts, particularly in the development of the multidisciplinary GIS minor, where there are ample introductory courses but too few advanced courses to develop specialized tracks. While tracks may not be required, the danger is that without them students will end up taking a hodgepodge of GIS courses, many at the introductory level.

We also had a number of issues with the computer labs. In the COS, the main PC teaching lab seats 40+ students, which is far too many to effectively teach GIS. Smaller computer lab spaces are needed (15-20 seats each). CAST has a small, specialized computer lab (DDL), but that is over subscribed due to specialized software needs. In addition, COLA has a small PC teaching lab, but the computers and server are too old to effectively run the software and databases. Ideally, one or more dedicated GIS labs need to be established to help centralize and facilitate teaching, research, and networking activities.

To address these issues and to continue the growth of GIS on campus, we recommend the following steps be taken:

1. Survey GIS instructors/users on campus to create an approved list of introductory/fundamental courses that will prepare students to take intermediate and advanced courses.
2. Survey GIS instructors/users on campus to identify redundancy and convert currently introductory level courses into intermediate and/or advanced GIS courses. Require courses at these levels to have the courses in bullet 1 as pre-requisites. Without pre-requisites, courses are diluted with students at the introductory level, making it difficult to expand the knowledge base of advanced students. This will help move along the GIS minor.
3. GIS applications are extremely technical. Teaching assistants should be required when classes are full or nearly full.
4. GIS exercise data should be loaded locally on all computer stations in teaching labs to eliminate technical errors and slow processing.
5) Survey all GIS instructors/users and create a central archive of GIS exercises that can be used in classes. We have started this process, but need an assessable central storage site (right now it is on Dr. Korfmacher’s desktop and backups). This will help instructors identify GIS-related research on campus and can provide a clearinghouse to assist in course enhancement.

6) Reduce class sizes to meet optimal instruction. Class size for introductory courses should be capped at 25, but only if TAs are available. Class sizes for intermediate and advanced courses (those with a introductory GIS prerequisite) should be capped at 15 and 10, respectively.

7) Expand the partnerships with groups like the Monroe County GIS Department and Pictometry. Monroe County currently has a GIS Training and Support Program where public users can seek assistance. This could be an opportunity for RIT students to receive field experience in applying their GIS skills. Pictometry was founded by RIT graduates.

8) Create one or more dedicated GIS labs of 15-25 seats and set up with high end computer and servers. Maintain the university site license for ArcGIS so that students can work on assignments in any lab if these teaching labs are in use. Two possibilities are 86-1110 and 86-1100, which were old computer labs and are still wired.